Gaussian fluctuations in a cuprate superconductor

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THEORY: $\nu\sigma = \alpha_{xy} / H$

Gaussian Fluctuations

$\nu\sigma \sim \xi_0^2 / (1+\varepsilon) \ln(1+\varepsilon)$

PRL **89,** 287001 (2002) & **102**, 067002 (2009)

Phase Fluctuations

$\nu\sigma \sim T^{-4}$

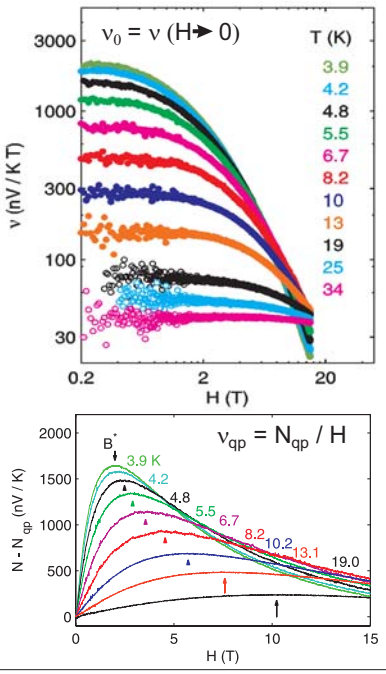
PRL **99,** 117004 (2007)

Definitions:

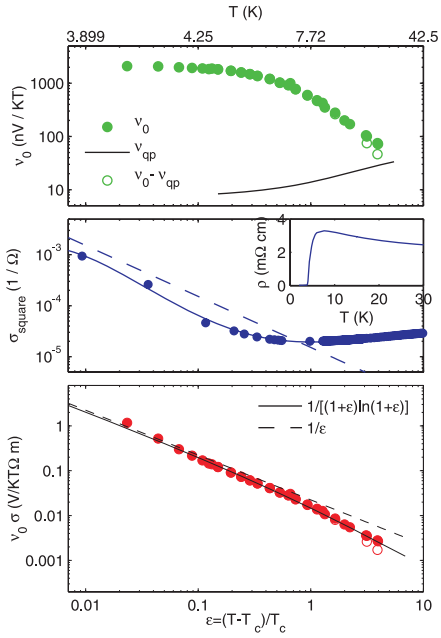
ν = Nernst coef. $\nu = N / H$
σ = Conductivity ξ= coh. length
α = Peltier coef. $\varepsilon = (T-Tc) / Tc$

EXPERIMENT : Nernst effect on $La_{2-x-y}Eu_ySr_xCuO_4$ (p=0.11; Tc = 3.86 K)

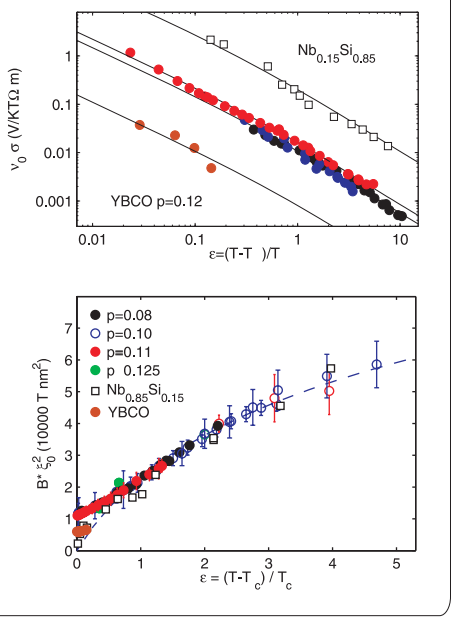
Nernst isotherms ($T > Tc)_p$



Exp. versus Theory

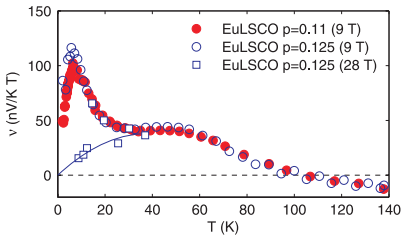


YBCO and $Nb_{0.15}Si_{0.85}$



Quasi-particle contrib. ν_{qp}

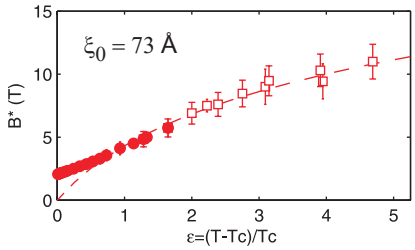
At H = 28 Tesla, there is no signatures of SC down to ~5K, hence $\nu_{qp} = \nu$ (28T)



*Ghost critical field B**

$$B^* = \frac{\Phi_0}{2\pi\xi_0^2} \ln(1+\epsilon) \qquad H_{c2} = \frac{\Phi_0}{2\pi\xi_0^2}$$

Φ_0 = Flux quantum



Coherence length & H_{c2}

Material	ξ_0 (Å)	H_{c2} (T)	Ref.
Eu-LSCO			
p = 0.08	59	9.4	
p = 0.10	65	7.8	
p = 0.11	73	6.2	
p = 0.125	52	12.2	
YBCO			
p = 0.12	30	37	[2]
$Nb_{0.15}Si_{0.85}$	127	2	[1]

References: [1] A. Pourret et al. Nat. Phys. **2**, 683 (2006), PRB **76**, 214504 (2007), NJP **11**, 055071 (2009)
[2] Y. Ando & K. Segawa, PRL **88**, 167005 (2002)